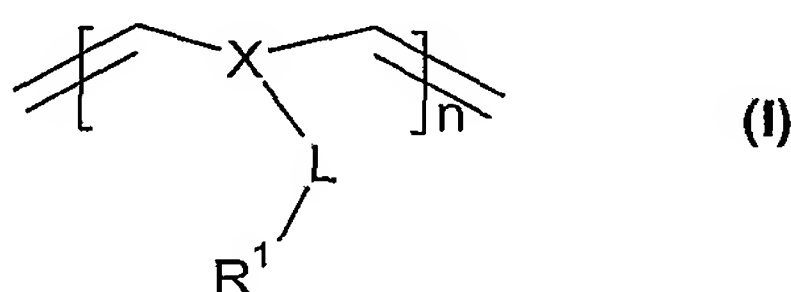


Claims

1. A method of coating the internal surface of a device with a polymer, the process comprising the steps of:
 - 5 (i) introducing into the device a solution of one or more monomers in a suitable solvent;
 - (ii) introducing a flow of an inert gas through the device; and
 - (iii) initiating polymerisation of the monomer solution.
2. A method as claimed in claim 1 wherein the device is a microfabricated device or a
 10 reaction vessel with an internal diameter of less than about 2mm
3. A method as claimed in claim 1 or claim 2, wherein the inert gas is nitrogen or argon.
- 15 4. A method as claimed in any one of claims 1 to 3, wherein the device is a microfabricated device or a loop from 1 to 100 cm in length.
5. A method as claimed in any one of claims 1 to 4, wherein the device is adapted to carry out a solid-phase radiochemical process.
- 20 6. A method as claimed in any one of claims 1 to 5, wherein the one or more monomers can be polymerised by ring opening metathesis polymerisation (ROMP) and the solution also includes a ruthenium carbene catalyst and a cross-linker.
- 25 7. A method as claimed in any one of claims 1 to 6, wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (I):



wherein:

- 30 X is either a C₄₋₆ cycloalkyl or C₄₋₆ heterocyclyl moiety;

L is a C₁ to C₂₀ linker group comprising one or more alkyl, alkenyl, alkynyl, C₄₋₁₀ cycloalkyl, C₄₋₁₀ heterocyclyl, C₄₋₁₀ aryl, C₄₋₁₀ heteroaryl, ether, PEG, sulphide, amide, sulphamide or a combination thereof; any of which may be substituted with one or more groups R²

5

R¹ is hydrogen, C₁₋₂₀ alkyl, C₂₋₂₀ alkenyl, C₂₋₂₀ alkynyl, C₄₋₁₂ cycloalkyl, C₄₋₁₂ heterocyclyl, aryl, heteroaryl, C(O)R³, C₁₋₂₀ alkyl-C(O)R³, C₂₋₂₀ alkenyl-C(O)R³, C₂₋₂₀ alkynyl-C(O)R³, nitro, isocyanate, C₁₋₁₀ alkyl-C(O)-C(R⁴)₂-C(O)-C₁₋₁₀ alkyl, aminooxy, nitrile, phosphorus chloride, succinimide, sulphonyl chloride, halogen, tosylate, mesylate, triflate, nonaflate, silane, OR⁴, SR⁴, N(R⁴)₂, N⁺(R⁴)₃, quaternary phosphorous, C₁₋₂₀ alkyl-R⁵, C₂₋₂₀ alkenyl-R⁵ or C₂₋₂₀ alkynyl-R⁵ or a group comprising an enzyme or a catalyst.

10

R² is C(O)R³, C₁₋₂₀ alkyl-C(O)R³, C₂₋₂₀ alkenyl-C(O)R³, C₂₋₂₀ alkynyl-C(O)R³, nitro, isocyanate, C₁₋₁₀ alkyl-C(O)-C(R⁴)₂-C(O)-C₁₋₁₀ alkyl, aminooxy, nitrile, phosphorus chloride, succinimide, sulphonyl chloride, halogen, tosylate, mesylate, triflate, nonaflate, silane, OR⁴, SR⁴, N(R⁴)₂, N⁺(R⁴)₃, quaternary phosphorous, C₁₋₂₀ alkyl-R⁵, C₂₋₂₀ alkenyl-R⁵ or C₂₋₂₀ alkynyl-R⁵.

15

R³ is H, OH, C₁₋₂₀ alkyl, OC₁₋₂₀ alkyl, N(R⁴)₂, N⁺(R⁴)₃;

20

each R⁴ is independently H or C₁₋₁₀ alkyl;

R⁵ is OR⁴, SR⁴, N(R⁴)₂, N⁺(R⁴)₃, C₄₋₁₀ cycloalkyl, C₄₋₁₀ heterocyclyl, aryl or heteroaryl.

25

8. A process as claimed in claim 7, wherein, in the ROMP polymer of Formula (I): R¹ is halogen, OH, SH, C₁₋₂₀ alkyl, C₄₋₁₂ aryl, C₁₋₂₀ alkyl-R⁵, C₁₋₂₀ alkyl-C(O)R³, N(R⁴)₂, N⁺(R⁴)₃ or a group comprising an enzyme or a catalyst.

where R³ is OH, R⁴ is as defined for general formula (I) and R⁵ is N(R⁴)₂, N⁺(R⁴)₃, aryl or heteroaryl;

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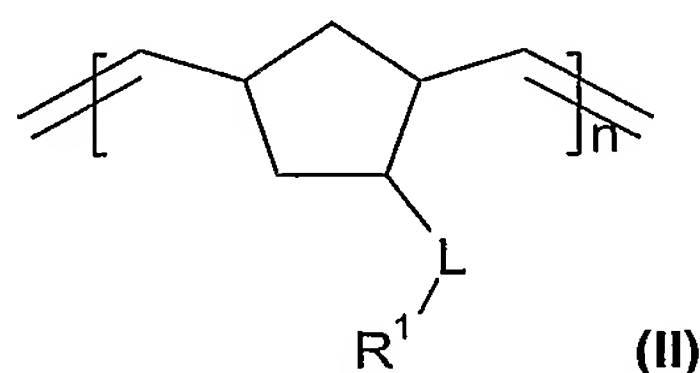
9. A process as claimed in claim 8, wherein, in the ROMP polymer of Formula (I) wherein R¹ is C₁₋₂₀ alkyl; -N=C=O, -SH or N⁺(R⁴)₃, particularly with bound ¹⁸F-fluoride ion

or comprises an enzyme or a catalyst; and R^4 is as defined in general formula (I).

10. A process as claimed in any one of claims 7 to 9, wherein the polymer of Formula (I) contains more than one R^1 group.

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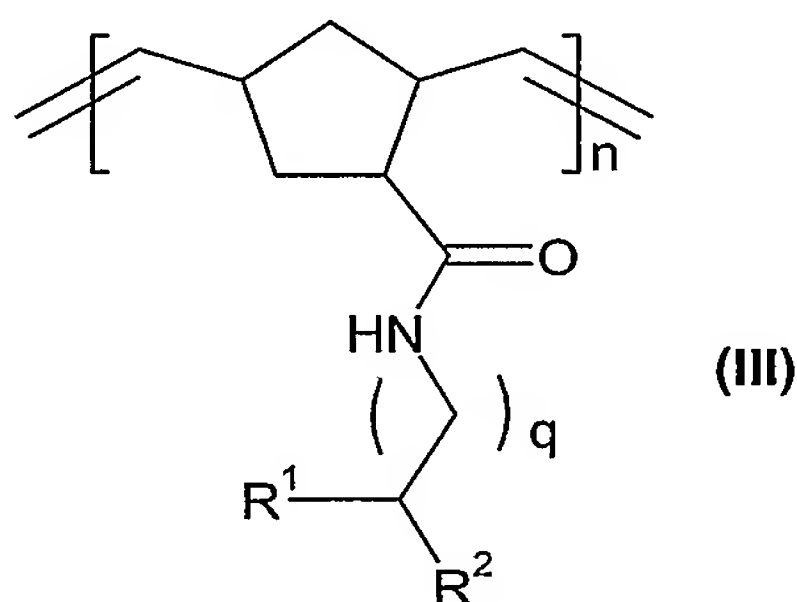
11. A process as claimed in any one of claims 1 to 10 wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (II):



10 wherein:

-L -, R^1 and n are as defined above for Formula (I).

12. A process as claimed in any one of claims 1 to 11 wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (III):



15

wherein:

R^1 and n are as defined above for Formula (I);

R^2 is an optional group as defined above for -L- of Formula (I); and,

$q = 1-4$.

20

13. A process as claimed in claim 12, wherein, in the ROMP polymer of Formula (III), R^1 is trialkylammonium, R^2 is absent, $q = 3$ and n = number of polymer units.

14. A process as claimed in any one of claims 1 to 13, wherein each monomer is

present in the starting solution in a concentration of from about 0.1 to 5M.

15. A process as claimed in any one of claims 1 to 14 wherein, in the monomer solution, the solvent is a polar aprotic solvent.

5

16. A process as claimed in any one of claims 1 to 15 wherein polymerisation is initiated by heating.

10

17. A process as claimed in any one of claims 1 to 15 wherein polymerisation occurs spontaneously.

18. A process as claimed in any one of claims 1 to 17, wherein the device is a microfabricated device and, the process of the invention comprises the initial step of creating a defined network of channels within the device.

15

19. A device comprising a microfabricated device or a reaction vessel with an internal diameter of less than about 2mm, wherein the internal surface is coated with a polymer substrate for a solid phase physical or chemical process.

20

20. A device as claimed in claim 19 adapted for carrying out a solid phase radiochemical process.

21. A device as claimed in claim 19 or claim 20, wherein the internal surface is coated with a ROMP polymer.

25

22. A device as claimed in any one of claims 19 to 21, wherein the internal surface is coated with a polymer as defined in any one of claims 7 to 13.

30

23. An automated synthesis system comprising two or more devices as claimed in any one of claims 19 to 22 which are fluidly interconnected

24. A method for recovering of ^{18}F -fluoride ion from ^{18}O -enriched water containing ^{18}F -fluoride ion, the process comprising passing the ^{18}O -enriched water containing ^{18}F -fluoride

ion through a device as claimed in any one of claims 19 to 22 or a system as defined in claim 23, in which the polymer coating comprises a ROMP polymer of general formula (III) in which R^1 is tri(C_{1-6} alkyl)ammonium, with a non-nucleophilic counter-ion, R^2 is absent and q is 3.

5 25. A method as claimed in claim 24 which is a step in the synthesis of an ^{18}F -labelled radiotracer.

26. A method for the synthesis of an ^{18}F -labelled radiotracer, the method comprising:

(i) recovering of ^{18}F -fluoride ion from ^{18}O -enriched water containing ^{18}F -fluoride ion passing the ^{18}O -enriched water containing ^{18}F -fluoride ion through a device as claimed in
10 any one of claims 19 to 22 or a device as claimed in claim 23 in which the polymer coating comprises a ROMP polymer of general formula (III) in which R^1 is tri(C_{1-6} alkyl)ammonium, with a non-nucleophilic counter-ion, R^2 is absent and q is 3; and

(ii) introducing into the device an unlabelled precursor compound of the ^{18}F -labelled radiotracer such that ^{18}F becomes incorporated into the precursor compound *via*
15 nucleophilic substitution to form the ^{18}F -labelled radiotracer.

27. A method as claimed in claim 26, wherein the ^{18}F -labelled radiotracer is:

2-[^{18}F]fluorodeoxyglucose (2-[^{18}F]-FDG);

L-6-[^{18}F]fluoro-DOPA;

3'-deoxy-3'-fluorothymidine (FLT);

20 2-(1,1-dicyanopropen-2-yl)-6-(2-[^{18}F]fluoroethyl)-methylamino)-naphthalene ([^{18}F]FDDNP);

5[^{18}F]fluorouracil; 5[^{18}F]fluorocytosine; or

[^{18}F]-1-amino-3-fluorocyclobutane-1-carboxylic acid ([^{18}F]-FACBC).